3. Subbasin Assessment–Pollutant Source Inventory

Sources of nutrients, bacteria, and dissolved oxygen demanding materials are not apparent in the Lower Kootenai and Moyie River Subbasins. All sources of sediment are non-point sources. Sources of thermal input are restricted to loss of stream canopy cover.

3.1. Sources of Pollutants of Concern

Pollutant sources of sediment are discussed in the following sections. Sediment is yielded to the subbasin from a large number of sources, including natural erosion. Activities in the subbasin such as forest activities, agriculture, and urban development are all sources of pollutants in the subbasin. Agriculture activities are limited to the flat fields in the floodplain and some upland areas with relatively flat topography. The upland agriculture areas have a higher sediment delivery potential than those restricted to the floodplain. Sources of dissolved oxygen demanding materials are not apparent.

3.1.1. Point Sources

There are no Superfund or Resource Conservation Recovery Act (RCRA) sites in the subbasin. The City of Bonners Ferry holds the only two NPDES permits in Boundary County (ID-002022-2), issued November 5, 1998, for wastewater and water treatment systems.

3.1.2. Nonpoint Sources

Nonpoint sources of sediment are discussed for the next several pages under the heading Sediment Sources, followed by a brief descriptions of nonpoint sources of thermal modification, in section 3.1.2.2, Temperature Sources.

3.1.2.1. Sediment Sources

Natural erosion processes noted as occurring within the Lower Kootenai and Moyie River Subbasins include hillslope creep, mass failure, and surface erosion. A common land type in the basin is gently to moderately sloping glaciated land, derived from granitics. In CWE assessments, this land type is considered to have a high inherent hazard for surface erosion and a moderate inherent hazard for mass failure. Such occurrences contribute large volumes of sediment to the stream.

The historic cycle of large wildland fires is normally considered as an event followed by significant short-term sedimentation pulses to streams. However, it is thought by some USFS hydrologists and soil scientists that historic, large stand replacing fires on the west side of the basin may not have greatly led to accelerated surface erosion because of the volcanic ash cap below the organic duff layer (Niehoff, personal communication). The ash cap is very porous and allows rapid water infiltration into the shallow groundwater stratum. Instead, intense fires may have produced a glazing effect on the ash cap, creating a hydrophobic condition. This condition accelerates water runoff, along with the open canopy from fire, but without a pronounced surface erosion scouring effect. Particularly during episodic precipitation, snowmelt, and flood events following a large fire, excess water runoff would have resulted in excessive stream energy, along with log debris dams, leading to significant stream bed cutting and bank erosion. Current instream degradation in the way of sediment accumulation, pool filling, and channel widening of some west side streams are in part attributed to large stand replacing fires.

Prior to the Idaho Forest Practices Act (FPA), timber harvesting on private land was unregulated. Early and mid-twentieth century timber harvesting was both in burnt and disease/insect affected areas for salvage logging, and in lands of unburned, mature growth stands for selective harvest of high value species such as white pine, spruce, hemlock and cedar. During this time there was construction of railroad lines and spurs, flumes and chutes, and a network of transportation roads, skid trails, jammer roads and spurs, and stream crossings. Some of the early transportation system was built close to streams, and within the streams themselves (chutes and flumes). In some areas there were clear-cuts of cedar and hemlock within riparian zones. IDL and USFS land managers consider that these early practices led to a significant yield of sediment to basin streams and that impairment within some basin streams still reflect these legacy practices.

Timber harvesting under the Idaho FPA (in effect since 1974), incorporates best management (BMP) standards for road building, harvesting design and extraction methods, stream crossings, maintenance, and the establishment of a stream protection zone (SPZ). Still, as harvesting continues to be a major activity in the basin, there is ongoing disturbance and compaction of forest soils and ephemeral swales by heavy machinery, skidding, and construction of new roads, stream crossings, and landings. In addition to unpaved roads as a known significant sediment source, there are also tractor excavated skid trails where the tractor blade scrapes and removes the volcanic ash cap (Niehoff, personal communication). There are a significant number of small blocks of forested acres in the basin that are privately owned and logged, collectively called Non-Industrial Private Forest (NIPF). Harvesting activities on these lands fall within the regulations of the FPA as administered by IDL. Forest audits conducted by a team of experts indicate that NIPF land owners generally have more departures from BMPs than found on public and industrial lands (IDL et al. 1993).

Roads

Roads built to facilitate timber harvest and other activities can be significant sources of sediment. A road system in forested lands includes: the road surface along with water runoff management structures such as rolling dips and cross culverts; down gradient fillslopes and up gradient cutslopes; drainage ditches; and stream crossings. Road systems produce sediment mass and a percentage of that mass can be delivered to basin streams. A common observed and measured feature of road segments is high variability in the mass of sediment produced, and many road segments produce little sediment but a few segments produce a large amount (Luce and Black 1999). The forested road density in the Lower Kootenai River basin is generally moderate to high, ranging from 2 – 7 mi/mi2 in many fifth order watersheds.

Sediment production from the road surface will vary according to such factors as inherent erodibility and runoff producing capacity of the soil and running surface, degree of gravel capping, road gradient and road segment length, sufficiency and maintenance of water runoff management structures, and road use. Road surface erosion may be accelerated by rut formation when vehicles travel the road during the wet, spongy conditions of spring thaw and peak runoff. Sediment production from the road surface and other parts of the road system does not equate to sediment yield to a stream. The ratio of production to yield often depends on the sediment exit point in proximity to stream locale, including the area of intervening forest floor which serves to function as a sediment trap settling area (Megahan and Ketcheson 1996).

Sediment production also comes from fillslopes and cutslopes. The cutslopes can contribute sediment to drainage ditches through soil creep, sheet wash, rilling, and slumping. A cutslope can intercept the shallow subsurface flow of forested floors, and this groundwater will surface and weep at the cutslope, at times accelerating erosion and slumping.

Mass failures occur along road systems, often more frequently than the mass failure rate in undisturbed forests. Mass failures have been partially inventoried in the basin, and overall they occur at a relatively low frequency.

Some basin watersheds have a significant length of road within 300 ft of perennial streams. These stream-course roads may be on steep benches where there is some distance to the stream, but steep slopes provide little sediment settling function and there is direct runoff to the stream. There are also stream-course roads along low gradient valleys which encroach into the riparian and floodplain zones. Besides the high potential of direct sediment yield to streams, these roads can also lessen the function of floodplains by both decreasing flooded area and reducing the degree of stream meander. In some basin watersheds, estimates of riparian road density are as high as 10 - 15 mi/mi2 riparian area (Panhandle Bull Trout TAT 1998a).

The overall trend in the basin of public agency and timber industry roads is a gradual reduction of the road network mileage. Some roads have been closed, abandoned, and/or obliterated; old jammer roads have become brushed in; and new road networks are more efficiently designed and maintained.

Private residential road density is increasing in the basin as land is converted from timber to rural home sites. When these roads are inventoried it is clear that many of them do not meet the standards of FPA roads. They are often not capped with gravel, they tend to become heavily rutted, and thus frequently graded which produces loose soil, and they do not have sufficient water runoff management structures when built on steep slopes. Homes along stream courses are often desired by homeowners, and thus overall, there is a high potential of sediment delivery from residential private roads to streams.

For all road types, sediment yield to streams on a per area basis is generally highest at stream crossings. Sediment production from the road system that approaches stream crossings can be delivered directly, unless there is a good system of pre-crossing runoff diversion, and a presence of structures such as sediment traps or check dams within the approaching ditch line. Gravel armoring of road approaches is another method of reducing sediment yield. Stream crossing culverts can be undersized, or become damaged or plugged, leading to cutslope, road segment, and fillslope failures into the stream. Excessive velocity from culvert discharges can gouge out the downstream channel, which in turn can leave a sufficient drop between the culvert lip and stream bed to prevent upstream fish migration.

Frequency of stream crossings is high in parts of the basin, reaching two crossings/mile of perennial stream. Inventoried crossings in the basin range from: well maintained, proper functioning, with BMPs such as gravel armor at the aprons and sediment traps within approaching ditches; to poorly functioning and maintained stream crossings with obvious high sediment erosion and slumping, along with stream bed damage downstream of the culvert discharge.

Agriculture

Alfalfa cropping on private lands occurs within the basin. For the most part, this activity produces only minor amounts of sediment export except during times of periodic tillage. There are stream segments within private agriculture land in the floodplain that in the past have been straightened. Also, drainage channels have been constructed in surrounding wet soil lands to expedite the spring drainage of water and subsequent tending to crops. By eliminating stream meander and creating channelized draining, stream energy increases to the point of widening and damaging stream banks, greatly increasing sediment yield. Occasionally, there is mechanical re-deepening of cross drainage channels, and for the short term this greatly increases sediment delivery to the parent stream.

Cattle grazing occurs on private lands as well as federal and state range allotments. There are several observed stream sections where direct cattle access has severely damaged stream banks and eliminated riparian vegetation needed for bank stability and stream shading. In areas where cattle have direct access to streams, there also is potential for fecal coliform pollution.

Urbanization

Urban sources of sediment include runoff from access roads, driveways, disturbed hillslopes, and particularly, new excavation and construction activities. Also observed is the removal of vegetation from stream riparian zones not regulated by the FPA (no commercial sale of timbered logs).

Home site development in the basin is often comprised of 5 - 20 acre “ranchettes,” which frequently include small numbers of large grazing animals that often have free access to streams running through private property.

Bank Erosion

In-stream bank erosion can be a significant source of sediment. From recorded field observations and results of the stream bank erosion survey, it is known that stream bank erosion can be a significant direct sediment contributor to basin streams. There are reaches along main stems of Rosgen C and F channel types with one or two confining banks that are at times high and steep. Areas have been documented where super saturated clay banks are eroding and sloughing, as well as unconsolidated sand-gravel-cobble banks. At times this is a natural condition related to insufficient root stabilizing vegetation. But there are observations where the condition has been obviously exacerbated by historic riparian logging, adjacent road fills, cattle access, and ATV, and four-wheel drive vehicle access.

Because some amount of bank erosion sediment is understood to be background, there is a natural background component built into the model.

It is extremely difficult to partition current stream bank erosion rates to related factors such as: 1) naturally occurring; 2) remnants of effects from historic fires followed by increased flows; 3) remnant effects of historic timber harvesting in the riparian zone and construction of a transportation network; 4) excess stream energy of peak flows related to hydrologic openings from timber harvesting; 5) channel straightening and conversion of wetlands and wet meadows for agriculture purposes; 6) excess current sediment loads which leads to a decrease in stream depth; and 7) the effect of floodplain encroaching roads, as the road can interfere with the stream's natural tendency to seek a steady state gradient, and at high discharge periods may cause the stream to erode stream banks and the stream bed.

3.1.2.2. Temperature Sources

The primary disturbance causing stream temperatures to rise is non-natural canopy modification by silvicultural and agricultural practices. Attainment of natural full potential canopy shade is the most that can be done to lower stream temperatures. This TMDL uses an approach that involves potential natural vegetation (PNV), which is further described in section 5.1.2.1.

3.1.3. Pollutant Transport

In this subbasin, pollutant transport is only relevant to sediment. Sediment is delivered to the stream system primarily during high precipitation-high discharge events or rapid snowmelt events. These are episodic events. Under these conditions, large volumes of sediment move in the stream systems. These conditions develop stream power and stage heights capable of channel alteration. Sediment trapped in upper low order watersheds moves quickly to the higher order streams of the subbasin. Streams with a steep gradient, constrained by roads, exhibit rapid erosion from the bed and banks.

3.2. Data Gaps

The major data gap in sediment pollution is not related to sources, but is related to in-stream measurements of load and transport of sediment. The major data gap in temperature pollution is the lack of temperature logger data from the entire length of the stream. Presently, most temperature profiles are created based on temperature data collected at or near the mouth of the stream.

3.2.1. Point Sources

No point discharges of sediment, heat, nutrients, bacteria, or oxygen demanding materials have been documented.

3.2.2. Nonpoint Sources

3.2.2.1. Sediment

Nonpoint sources of sediment have been modeled rather than measured. In-stream measurements of the sediment load would be of value. Such monitoring is expensive. It is unlikely that this data gap will be filled. Model results are the best available data.

3.2.2.2. Temperature

Current temperature data was collected from in-stream monitoring at set locations.

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